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The Johns Hopkins Magazine

IN THIS ISSUE

Physics Demonstrations

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VOLUME VIII May, 1957 NUMBER 8

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The Cover: Here, ladies and gentlemen, you see an ordinary ball, defying the law of gravity. No strings, no wires, no optical illusions. And if you'll step inside the tent, you'll find more breathtaking wonders to behold. Rays that shine through light-proof barriers. A speeding car that tosses a ball into the air, passes beneath a bridge while the ball flies over it, and neatly catches the ball as it pursues its hurtling course. Waterspouts that support heavy objects, never letting them touch the ground. And a death-defying leap by a panda bear who is being pursued by a relentless hunter. The show is under way now, starting on page 8. Don't delay. See it!

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EDITOR'S NOTES
AN INFORMAL REPORT

As we write this, we are aboard a "glamour train"★ bound for Greenville, South Carolina. We are reclining in a bed ("deep and luxurious"◑) in Cashier's Valley♂, pondering the events of the DAY●.

We reached Cashier's Valley a few minutes ago by lurching our way through Patapsco River and Vadkin River (both were dry, thank goodness) from Memphis. Memphis, you should know, is a club car on the glamour train. It was designed to make us feel "relaxed and at home."◪

We went to Memphis because we needed a timetable. We needed a timetable because ours was, and still is, in our suitcase. Our suitcase was, and still is, stuck fast beneath our seat. (A porter put it there, grunting as he did so, making us feel thankful that it contained no fragile souvenirs for our friends in Greenville.℘)

Got the picture?

Off in search of timetable. First we tried a timetable rack in Cashier's Valley; empty. Then we tried a timetable rack in Patapsco River; empty, too, except for a copy of the 1956 Hotel Red Book. Next, the rack in Vadkin River. Ditto.

In Memphis, there was no timetable rack in sight. There was, however, a white-jacketed waiter who greeted us warmly.✦

"D'you have a timetable?" we asked.

The waiter allowed as how he might be able to find one, but it might take a little time. Meanwhile, would we be interested in perusing a little reading matter, which he happened to have in hand?

We found the reading matter to be a list of homelike goodies.⁎ It turned out they were available, by coincidence, right there in homelike old Memphis. Playing cards: bridge or pinochle. Cigarettes. Rye, bourbon, scotch, beer. Soft drinks.

It looked like this (although the condition was never specified): no goodies ordered, no timetable brought. For the waiter was still waiting.▲ (Let's be fair about this. Maybe he was waiting because he was thinking; thinking of someplace he could find a timetable. Maybe the place where he was standing —i.e., right beside our chair—was his lucky thinking spot. Maybe that card he was holding in his hand had reference notes✱ on it. Who knows?)

Well anyway, we thought *we* knew otherwise. Ordered a scotch. Waiter shook his head.

"We're in Virginia."

You see? He *was* thinking. Thought we thought we were in Scotland. Thought he'd correct the impression.

We thanked him for the information.

"What I mean is, nothing but beer in Virginia," he said.

Disillusioned, we explained beer gives us a headache on trains.⊗ Waiter was disappointed but helpful.

★ Railroad advt.

◑ *Ibid.*

♂ It took a lot of nerve to name a railway car Cashier's Valley. Cashier's Peak might be a better description, say we, the memory of paying for our ticket still fresh in mind.

● From 12:01 A.M. to 12 NOON, inclusive, is shown in LIGHT face type.—*Railroad timetable.*

◪ Railroad advt. Found on seat in an empty roomette.

℘ Wedgwood china, Royal Copenhagen porcelains, etc.

✦ We have nothing in particular to say at this point. It's been a long time since we last had a footnote, however. Felt in need of one.

⁎ Club car was supposed to make us feel at home, remember? Forgotten, eh? See note ◪ back a few footnotes.

▲ His wont. Judging from his title, anyway.

✱ Although "Reference Notes" is what they call footnotes on a timetable, this isn't what we mean here. Incidentally, if this were a *real* timetable, you'd have to turn to page 10, or someplace equally awkward, for the reference notes pertaining to page 2. Just be thankful this is a *magazine.*

⊗ Once we got a headache on a train in New Jersey. Asked dining-car steward to sell us a tin of aspirin. He handed us the bill of fare. Whole page devoted to laws governing sale of things in dining car. Under NEW JERSEY, it said, "State law forbids sale of aspirin except upon doctor's prescription or in pharmacies." Hadn't had foresight to bring doctor's prescription. Kicked ourselves. (This cleared up the headache, by the way.)

"Playing cards, maybe?" he said. "Bridge deck? Pinochle deck?"

Inedible, we said. Gives us ulcers. Did he, perhaps, have a Coke?

Well, Sir, the man was transformed. Memphis© glowed with the radiance from his smile‡. In two minutes, a Coke appeared. Simultaneously, a timetable appeared. Thirty seconds later, the waiter's very own reference card appeared ●. On it, however, there were no reference notes.

Only a figure: twenty-five cents.

Expensive timetable.

Now, as we write, we are on a car called Thrush. The rest of this column went to the printer a day ago, but we feel we must add a few notes—if for no other reason than to prove we're not sour on railroads.

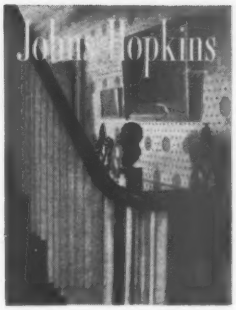
Thrush is on a different rail line, in a different state, headed for a different destination (Chicago). It has a nice name, about which we could think of nothing cynical to say, even if we wanted to. And we *don't* want to. The timetable racks in Thrush are packed with timetables. The club car, Harper's Ferry by name, serves scotch. There is a fine clickety-clack beneath the wheels. We shall sleep well tonight, uncompelled by circumstances to sit at our writing-pad and put down indignant thoughts. And tomorrow morning, in Chicago, we shall post this grateful Addendum to our printer, who, being a good printer, will somehow manage to squeeze it in.

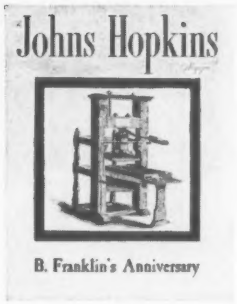
	WESTBOUND READ DOWN	EASTBOUND READ UP
	Somebody however	table time
	(SKIP THIS SPACE IF YOU WISH)	readable a publish to way
→	should figure →	a out

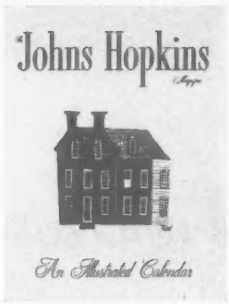
© Club car. See footnote ◪.

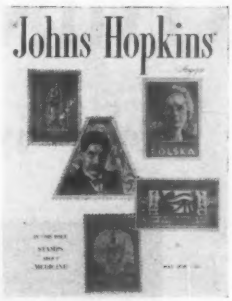
‡ This is a phrase we picked up someplace. We have been waiting for years for an opportunity to use it.

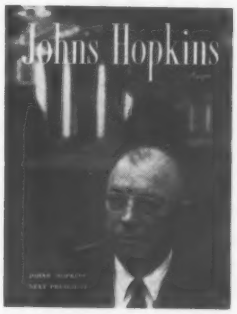
● Remember that reference card? No? Well, we mentioned it a while back. Please pay attention.

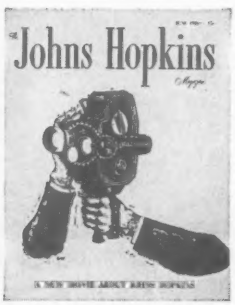


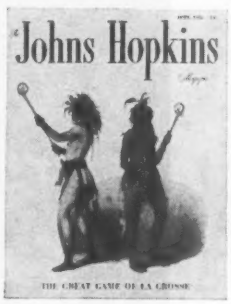


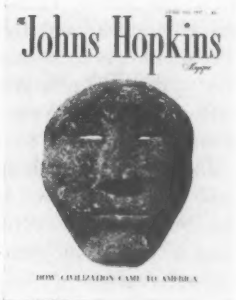


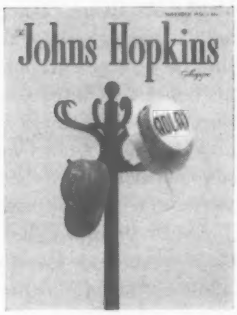












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THE COMING CHOICE F

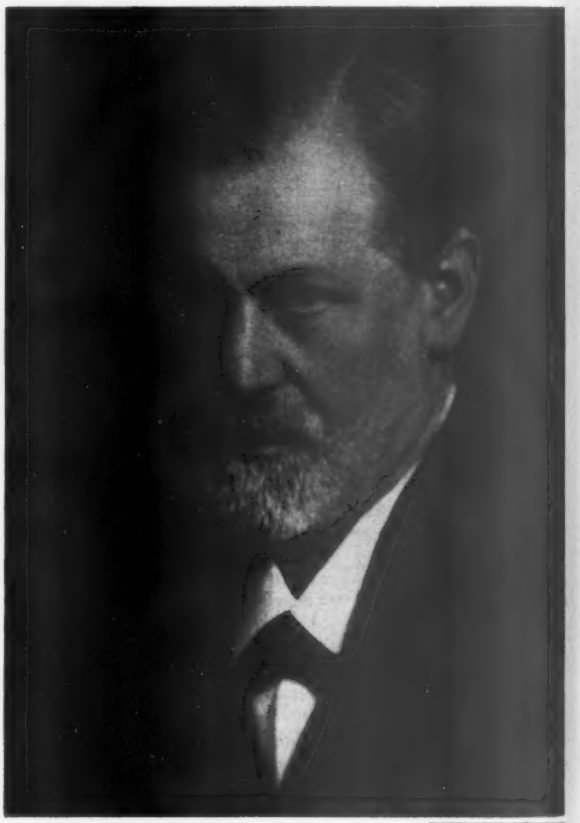
Some say it is time to re-examine the

THE doctrines of Sigmund Freud, conceived primarily for the benefit of psychiatry, have proved so persuasive and attractive to those who have come in contact with them that they have permeated the whole of Western culture. Like Darwin and Marx, Freud was one of those giants of thought whose ideas sent civilization off in a new direction. Freudian concepts—such as his belief that human behavior is directed primarily by unconscious instincts and early childhood experiences, and that man's chief mental energy is derived from his sex instinct—have become accepted in the broadest sense. They have influenced literature from James Joyce to Philip Wylie, drama from Eugene O'Neill to George Axelrod. Even the man in the street, who may know nothing about Freud himself, is aware of his superego, his Oedipus complex, and his Freudian slip.

In view of this broad acceptance of Freud, it is significant that there are growing organizations in the United States made up of scientists who believe that a completely different approach to psychiatry is possible and desirable. One such organization is the Society of Biological Psychiatry; another is the Pavlovian Society, headed by W. Horsley Gantt. Dr. Gantt is founder and head of the Pavlovian Laboratory at Johns Hopkins, an institution whose psychiatric staff includes Freudian psychiatrists as well as those representing other schools of thought.

This is not to say there has been any lack of earlier disagreement with Freud. He has been attacked almost continuously since his first papers were published in the closing years of the nineteenth century. The basis of most of these attacks (excluding those from clergymen or moralists who protested Freud's emphasis on sex) is that Freudian psychiatry and its tool, psychoanalysis, are not objective; that they are, in other words, not science.

Today the psychoanalysts are still the most influential psychiatrists in the United States.



BETTMANN ARCHIVE

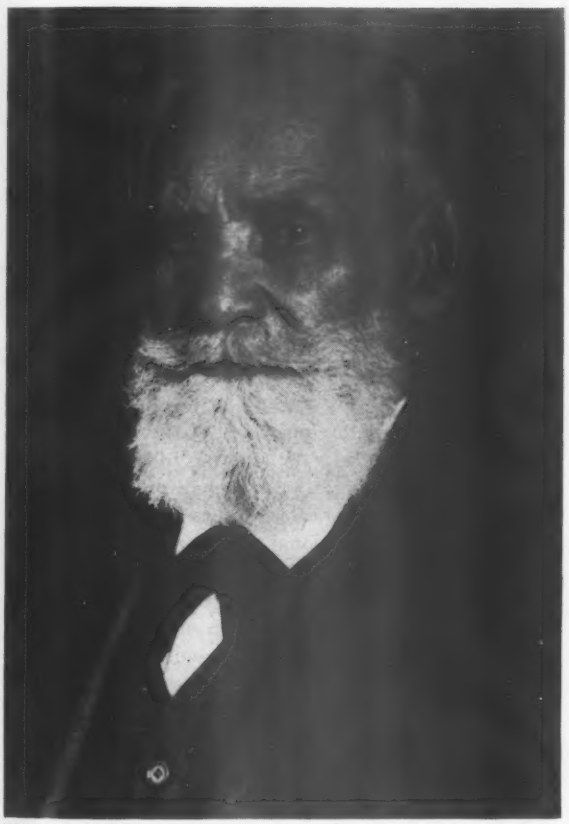
Sigmund Freud

The psychiatrists of Dr. Gantt's circle are not actively attacking Freud. They are, instead, preparing to offer a purely objective approach to psychiatry. The discipline they are building depends on data gathered over many years. In the case of Dr. Gantt's own work, he envisions not only the possibility of new methods of

By GWINN OWENS

CE FOR PSYCHIATRY

nine the field for scientific objectivity



BETTMANN ARCHIVE

Ivan Petrovich Pavlov

therapy, but a new kind of *preventive* psychiatry as well. All the data involved in Dr. Gantt's work are obtained by strictly scientific methods.

There are points of agreement between Freudian and Pavlovian psychiatrists. The Pavlovians find some of Freud's theoretical concepts useful, while the Freudians are beginning to look with interest on some of the data provided by those who insist on the objective approach. Dr. Gantt, like Pavlov, does not deny the importance of our subjective life and all it entails; on the contrary, he strongly affirms it. But he believes it is a fallacy to accept a subjective report as representing more than the feelings of an individual.

The point of difference hinges on two words: subjectivity and objectivity. Dr. Gantt's attitude toward psychoanalysis is that, in order to be brought out of the realm of speculation, its hypotheses should be subject to verification, just as are the hypotheses of other branches of medicine; he thinks there is great need for an objective, scientific approach, using the methods available to us through the development of twentieth-century science. This approach, he thinks, has been greatly neglected in psychiatry. Some Freudian theories, for instance—such as the influence of one person on another—Dr. Gantt has substantiated through laboratory procedures. But others—for example, the attributing by Freud of sex as the origin of all neuroses and psychoses—are not consistent with the findings in Dr. Gantt's Pavlovian Laboratory.

Eugene Pumpian-Mindlin, editor of *Psychoanalysis as Science* and a Freudian who speaks with candor, emphasizes this point of difference: "Are . . . psychoanalytic data and theory verifiable in the laboratory? I am afraid that we must face the fact that they are not subject to direct verification in this manner at the present time."

Not all psychoanalysts agree with Dr. Pumpian-Mindlin. Some say objective proof *is* available. But generally speaking, the alleged lack of objectivity in Freudian psychiatry is the heart of the controversy.

Thus—since there is a question as to how much compromise is possible between a group of men who believe profoundly that a medical discipline must be based on laboratory data painstakingly gathered through years

COMING CHOICE FOR PSYCHIATRY

Continued

of controlled experimentation, and an opposite group who believe, equally profoundly, that an inspired man's, Freud's, insight into the human mind produced concepts that can be accepted as true and as a basis for bringing relief to the mentally disturbed—in the long run a choice between the two schools of thought in psychiatry seems likely.

HERE is an example of the divergence of opinion.

One of the basic Freudian concepts is the Oedipus complex. This, according to Freud, refers to the feeling which every male infant has: a desire to possess his mother and to destroy his father, who represents a rival for his mother's affection.* Because of this resentment of his father, he fears constantly that his father will mutilate him. The stresses which the complex engenders when it conflicts with cultural training, and the child's subsequent repression of the Oedipal feeling into his unconsciousness, is believed by psychoanalysts to be at the root of many adult neuroses. The psychoanalyst guides his therapy on the assumption that this Oedipus complex exists.

An objective psychiatrist would ask, first of all, How do you know the complex exists in a given patient? What factual evidence do you have? May not an analyst, through his own conviction that the complex exists, question his patient in such a way that—unwittingly, perhaps—he implants in the patient's mind an Oedipal idea that did not previously exist?

Regardless of the evidence that Freud turned up in probing the unconscious minds of many patients, the objective psychiatrists would insist the universal application of the Oedipus complex is open to question. The complex, the objective psychiatrists say, should not be accepted as a principle without factual verification and substantiation that the symptoms are more than what might stem from the suggestive influence of the psychiatrist and his aura. For this reason, they believe a psychoanalyst might compound an error when he entrusts the delicate balance of a patient's mental state to an unverified interpretation of signs of a complex that was subjectively conceived in the first place.

In *Psychoanalysis as Science*, not only Dr. Pumpian-Mindlin, but also Laurence S. Kubie [Johns Hopkins M.D. '21], psychoanalyst and clinical professor of psychiatry at Yale, makes a plea for objective methods of studying such Freudian concepts. Dr. Ernest R. Hilgard, an experimental psychologist, concedes in the same volume that "an experimental approach to this [psychosexual] theory is a large order."

THE origin of the discipline that presents an objective approach to psychiatry, in contrast to Freud, was in the laboratory of Ivan Petrovich Pavlov, the Russian physiologist, around the turn of the century. The experiment with Pavlov's dog is well known. Here, briefly, is what happened:

Pavlov, after devising a method to measure the secretion of the dog's salivary glands, showed the animal some food and observed an increase in the secretion. Next he showed the dog some food and at the same time rang a bell, a procedure that was repeated numerous times. The salivary glands continued to secrete. Then the bell was sounded without the simultaneous appearance of food—and the salivation still occurred. The association of the bell with food had persisted to the point where the bell produced the same reaction the food formerly produced.

For objective psychiatrists who are followers of Pavlov this experiment is of historic importance. It provided a means of measuring quantitatively a mental condition, and served to establish, through laboratory evidence, what Pavlov called the conditional reflex.*

The dog was innately possessed of the *un*conditional reflex—that is, the salivary reaction to food. Through a learning process, he came to have a physiological response to a mere symbol for food, as if it were the food itself. This is the conditional reflex.

Extending this comparatively simple observation to its ultimate interpretation, it would appear that an individual's psychic makeup is composed of a great number of innate responses—unconditional reflexes—on which, during his lifetime, are superimposed a great number of learned responses—conditional reflexes.

Dr. Gantt agreed that the following from the writer's own experience is an example of a human conditional reflex:

A young woman, driving with him in a car on a foggy night, is puzzled as to why the yellow fog lights on some of the approaching cars cause her to feel slightly nauseated. Probing her memory, she finds the answer. When she was very young, her family took many long trips in an old open car, and she inevitably became car-

* Oedipus was a Greek mythological hero who, it was prophesied, would kill his father and marry his mother. Unwittingly he did so; when he learned what he had done, he blinded himself, and Jocasta, his mother, committed suicide.

* Dr. Gantt uses the term "conditional reflex" instead of the more common "conditioned reflex" because the former is the proper translation of the Russian term Pavlov used.

sick. In her uncomfortable condition, she watched the lights of the oncoming cars which, through the isinglass curtains of the early automotive era, looked yellow. Hence the association of yellow headlights and nausea persisted even to her adulthood.*

It is not difficult to imagine the vast number of similar conditional responses to which all human beings are constantly subject, and the complex assortment of associations placing strains upon the mind.

DR. GANTT was an associate of Pavlov in the latter's laboratory in Russia from 1922 to 1929. On his return to America he established, under the direction of the late Adolf Meyer, the Pavlovian Laboratory, associated with the Johns Hopkins School of Medicine and the Phipps Psychiatric Clinic of the Johns Hopkins Hospital. Here, work on Pavlovian principles has been carried on for twenty-seven years. Two years ago, at the time of the laboratory's silver anniversary, Dr. Gantt was instrumental in founding the Pavlovian Society, which now has a distinguished membership.

With the help of his associates, Dr. Gantt has accumulated a great mass of objective data on the responses of dogs to a variety of controlled stimuli, such as food, noises, and electric shocks, carrying on Pavlov's work and vastly extending and broadening it.

"The objective method," Dr. Gantt says, "notes and records movements, secretions, heart rate, respiration, metabolism, temperature, and internal secretions in the presence of a certain stimulus in a certain environment in an individual with a certain history."

This he contrasts with "anthropomorphic interpretations that are incapable of verification."

Dr. Gantt drills his medical students in an exacting kind of objective description which he believes is essential to science and which he regards as the antithesis of subjective descriptions, which may be valid only for the individual making them. "A subjective description of Jones by Smith is more likely to be a description of Smith," Dr. Gantt says.

John Dos Passos, the novelist and biographer, a personal friend of Dr. Gantt, gave a layman's idea of objective description at the Pavlovian Laboratory's twenty-fifth anniversary program.

"Objective description demands a sort of virginity of the perceptions," he said. Later he likened the objective scientist to a hunter who must "become for the moment just an eye and an ear and a gun."

* A psychoanalyst who reviewed this article before publication noted, "Psychoanalytically, this girl's behavior would be referred to as 'regressive,' in that an earlier pattern was reintegrated under the stimulation of yellow light."

DR. JOSEPH WORTIS, a practicing objective psychiatrist in New York and a member of the Pavlovian Society, succeeded, as a young man, in gaining the rare privilege of being psychoanalyzed by Freud himself in 1934. He kept careful notes on the analysis and published them in 1955 in a book, *Fragments of an Analysis with Freud.*

Like Dr. Gantt's Jones-Smith example, Dr. Freud talking about Dr. Wortis appears to reveal a lot more about himself than he does about his patient. Dr. Wortis' picture of the father of psychoanalysis was devastating: a man who appears to be rigid yet inconsistent, impatient of criticism, and constantly groping at far-fetched ideas in support of his dogma.

Dr. Wortis was challenged by Freud with this defense: that the person who doubts the effectiveness of psychoanalysis is a victim of a condition that Freud himself "discovered," known as *resistance.* That is to say the doubter's doubts are actually a resistance against the exploration into his unconscious because he does not want to bring into consciousness some unpleasant repressed memories.

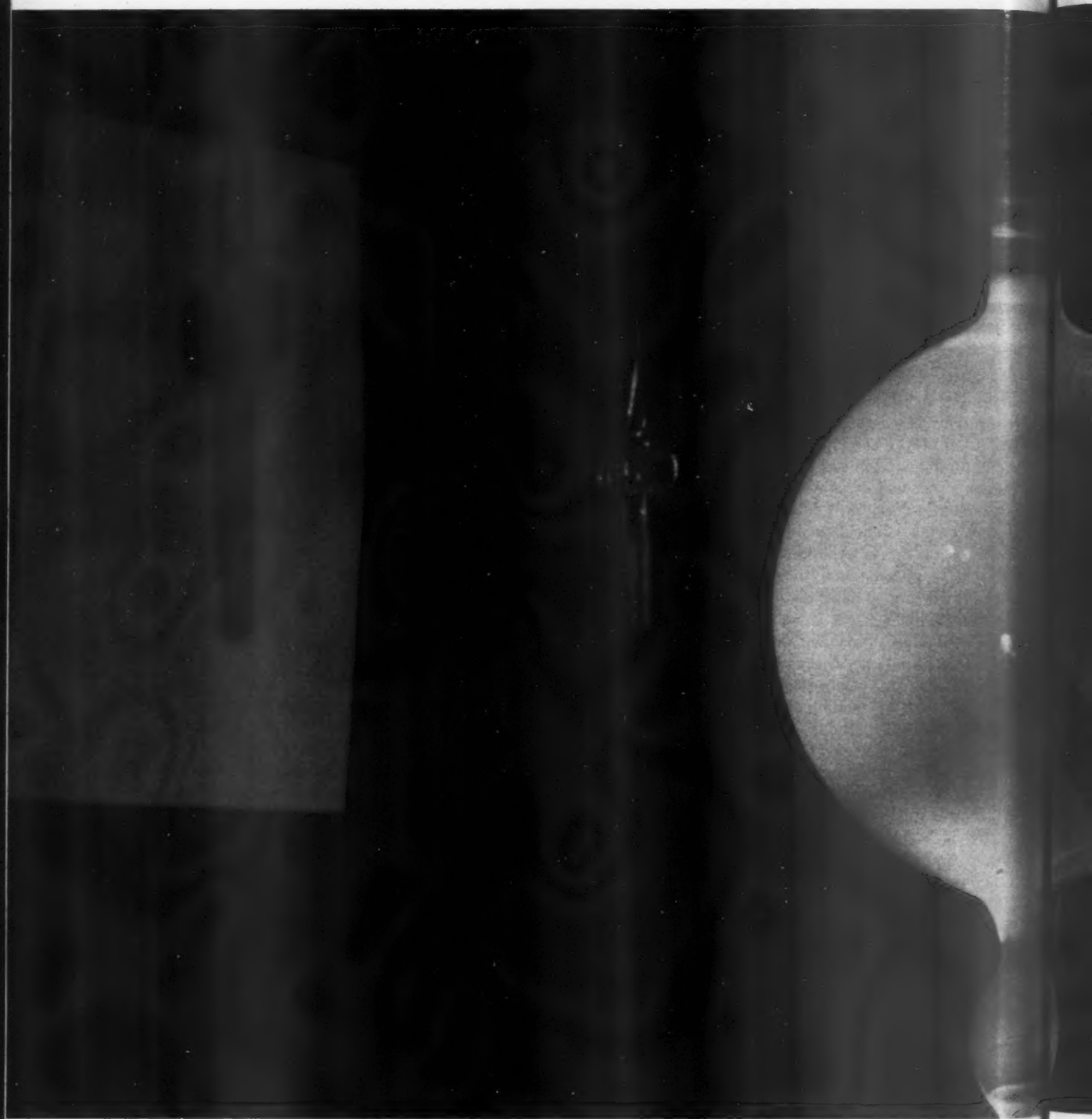
"If one does not have the right to criticize without being called 'resistant,' or if one does not have the right to criticize unless he has been psychoanalyzed," says Dr. Gantt, "the only alternative is to agree with the Freudians and to accept their authority."

"The trouble basically," wrote Dr. Wortis in the summary chapter of his book, "was that I could not accept Freud's scientific views because both his approach and his conclusions were suspect to me. This is not to say that in many matters, great and small, he was not right (as he certainly was in many of his comments to me), but the psychoanalytic structure as a whole seemed rickety, infirm and without solid foundation."

THE question immediately arises: If Freudian principles are without solid foundations, how is it that psychoanalysis effects cures? To this, Dr. Gantt agrees with other critics of Freud that 1) the excessive claims of psychoanalysis have never been substantiated by statistical or scientific methods to which other therapies are subjected; 2) there has been no statistical comparison of psychoanalytical procedures with other forms of therapy; 3) the successful psychoanalytic cures (which may often occur in the hands of a good psychiatrist, whether or not psychoanalytical) are often explainable on principles which are not specifically Freudian.

One such principle, used extensively by objective

Continued on page 21



Photographs for the Johns Hopkins Magazine by Alan J. Bearden

X-rays have wave-lengths about ten thousand times shorter than light waves, and hence are invisible. Unlike light (which, when it hits a solid object, bounces), x-rays penetrate solids and are absorbed by them in relation to the solids' density; those rays not absorbed come out on the other side. This penetration, the unique characteristic of x-rays, is used to demonstrate their

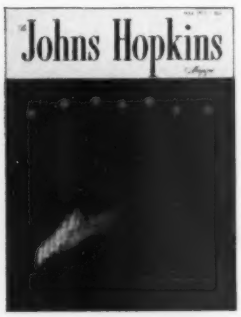
existence. The x-ray tube in the photograph (above right), is shielded by a sheet of black paper so that no light passes from it to the key or the fluorescent screen at the left. (The key is lit by a flashlight.) Radiation passes freely through the black paper but is absorbed by the metal key. A distinct key-shaped shadow appears on the x-ray-sensitive, flourescent screen (*at far left*).

Quod Erat Demonstrandum

BASIC PRINCIPLES ARE SHOWN BY INGENIOUS EXPERIMENTS

STUDENTS seem to understand the basic principles of physics best when they are taken out of the textbooks' abstract language and actually demonstrated. For years J. Alvin Bearden (lecturing below) and Richard T. Cox, professors of physics, have been giving demonstrations as an integral part of the introductory physics course taken by most science and engineering students at Johns Hopkins in the sophomore year.

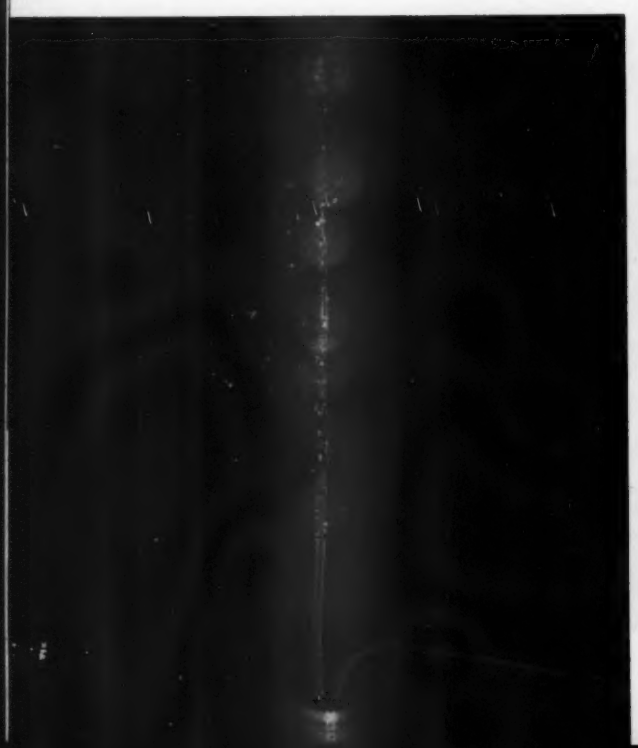
The demonstrations are fast-moving (about six experiments are done at each weekly lecture) and have become widely popular with the students. Between one hundred eighty and two hundred experiments are demonstrated each year. Many of them are standard, but every now and then a new one is added. The faculty members who give the course at Johns Hopkins have developed more than half the demonstrations currently given.

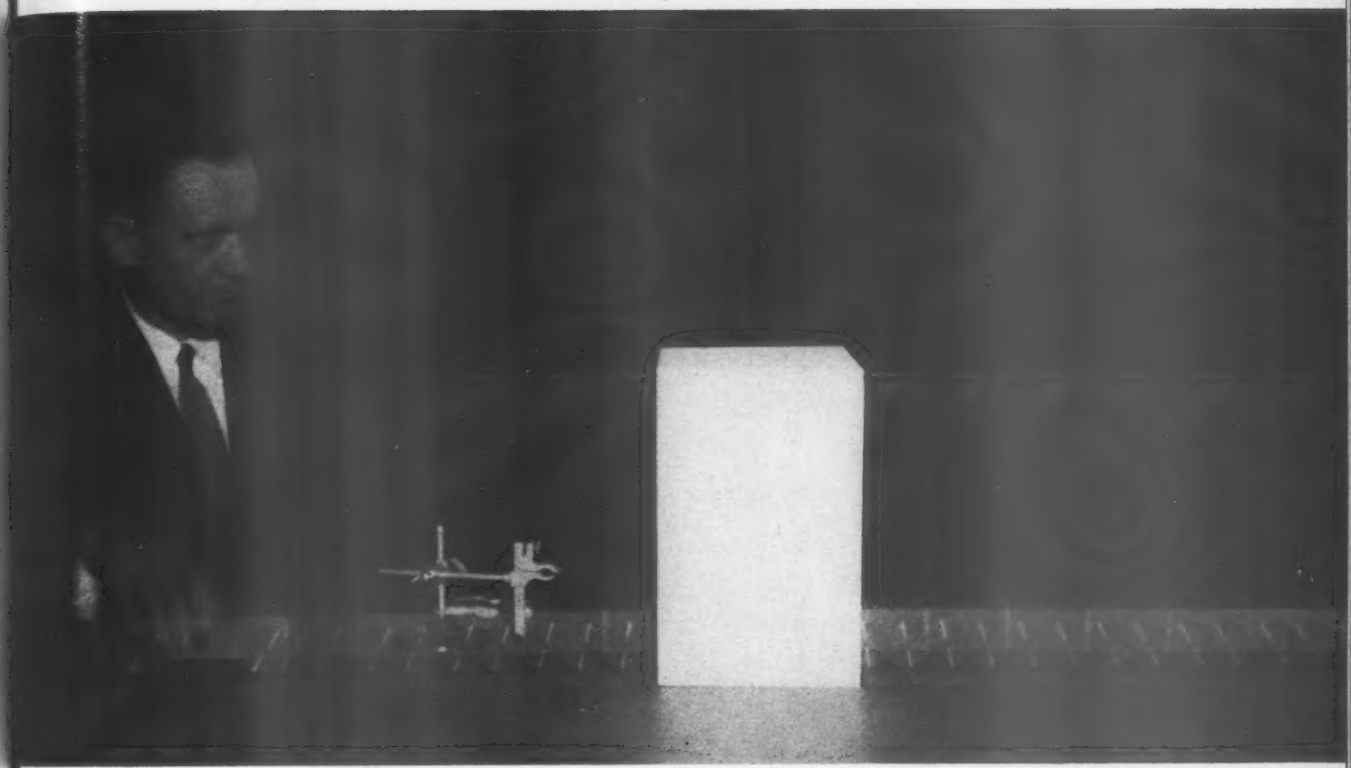


Q.E.D.:

THE BERNOULLI EFFECT

To demonstrate the principle first set forth by Bernoulli, that a stream of fluid passing a surface at high velocity will create an attractive force between the stream and the surface, a stream of water or air is forced through a small tube at high pressure and used to balance a ball at the top of the column. Because of the high speed of the fluid, it creates a region of low pressure which maintains the ball in its position of apparent levitation. The photographs show both a single ball maintaining its position at the end of a water stream and (in the multiple-exposure photograph, left), how a ball can be raised or lowered simply by changing the water or air pressure. It is this principle which allows a baseball to "curve" when the pitcher imparts a spinning motion to it as it leaves his hand.





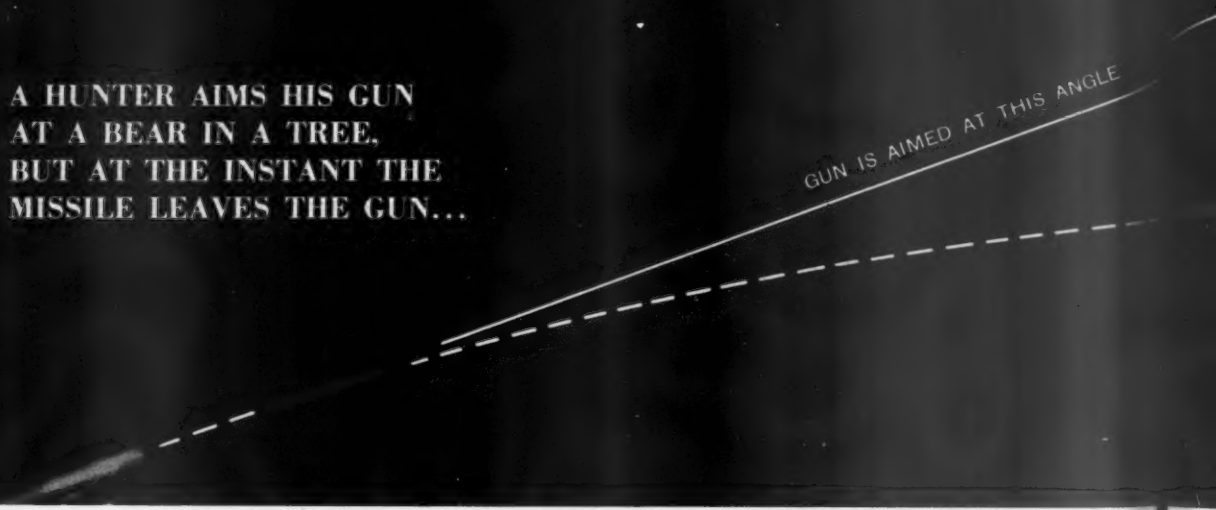
Q.E.D.:

HORIZONTAL AND VERTICAL VELOCITIES OF A BODY ARE INDEPENDENT

WHEN Professor J. A. Bearden pushes the car shown in the photograph above, it passes a mounted razor blade which severs a taught string, releasing a tightly coiled spring. When the spring, concealed by the lower part of the funnel, expands, it shoots a wooden ball vertically into the air (the ball is leaving the funnel immediately to the left of the bridge in the picture above). The ball's vertical motion causes it to rise above the level of the bridge, while the horizontal motion, imparted to it by the car, enables the ball to travel forward at the same rate as the car. Thus it falls back into the funnel on the other side of the bridge. This demonstration is used to illustrate the principle that vertical and horizontal velocities act independently of each other, although, in this case, they are acting simultaneously.

It is this principle which makes it necessary for a bombardier to drop his bombs considerably before his plane is over its target. That the bombs travel with the same horizontal motion as the plane is shown by the fact that, if the plane's speed is constant, the bombs can be seen under it all the way down.

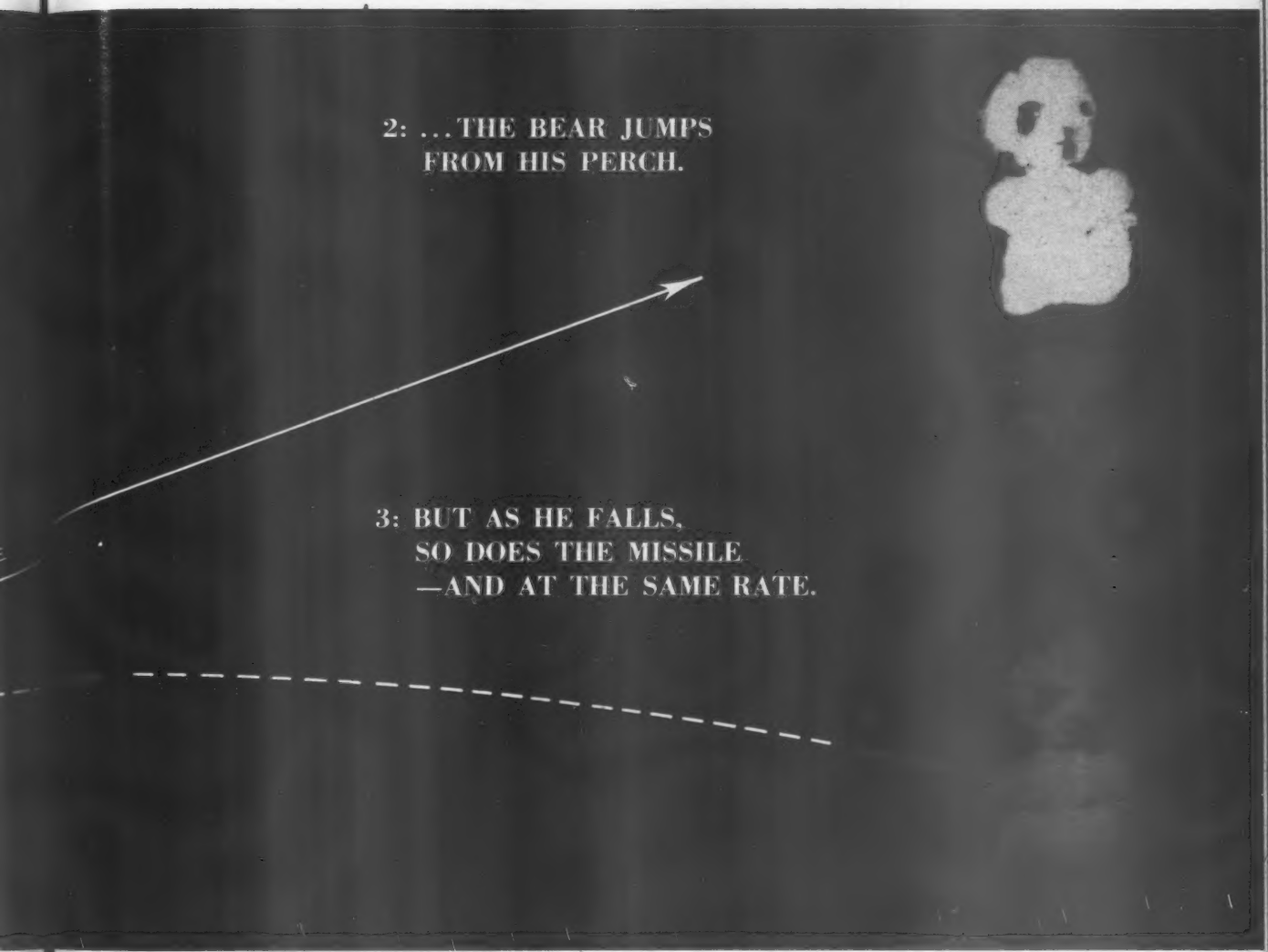
1: A HUNTER AIMS HIS GUN AT A BEAR IN A TREE, BUT AT THE INSTANT THE MISSILE LEAVES THE GUN...



At the instant a missile leaves a gun muzzle (*lower left corner*) it breaks the circuit of an electromagnet causing a stuffed animal (*top right*) to fall. Gravity acts with equal force on both the dart and the animal, even though the dart has a high horizontal velocity and the animal is falling straight down.

Q.E.D.:

GRAVITY OUTSMARTS A WILY BEAR CUB



THE law of gravity works in strange and wondrous ways. Here is a physics-course demonstration that proves it.

A wily hunter, the professor tells his students, is on the trail of an equally wily bear. Finally, they come face to face in a forest. The bear, seeking to escape, scampers up a tree.

But, on the tree branch, he makes a fine target. The hunter aims his gun. He sights it carefully; he takes fully a minute to do so.

The bear thinks fast. "The gun is pointed right at me," he says. "I can see into its barrel. I can see the missile, waiting to be fired. Aha!

"At the moment it leaves the gun barrel, I shall jump. And the bullet will pass harmlessly over my head."

And so he did.

But he did not reckon with gravity.

For, at the same rate that the bear falls, the missile —also pulled by gravity—falls, too. And, unfortunately for the bear, animal and bullet reach the same point at the same time.

That's why smart hunters have adjustable sights on their weapons. And smart bears take physics courses.

Edmonds

SCIENTISTS FOR THE FUTURE

A new program to fire high school students with interest in science has been launched by the Johns Hopkins Operations Research Office

By JOHN BALLOCH and JEAN TAYLOR

A LONG-HERALDED, but nonetheless alarming, problem looms on the American horizon.

By 1965, according to a recent report, the United States will need 1,680,000 scientists and engineers to maintain its present rate of growth. But by the same date there will be a deficit of approximately 457,000 in our technical labor force.

The key to the problem lies in a disturbing fact: too few young people, nowadays, are willing to take up science careers. The raw material is available: there is a sufficient pool of potential scientists in the high schools to meet present and future needs. But the problem—and a tough one—is to encourage these good students to attend college, to make it financially possible for them to do so, to provide adequate teaching staffs and facilities, and to persuade the students who have the potential to pursue scientific and engineering careers.

One of the chief deterrents to young people's entering science as a career seems to be a lack of information about scientists and about the requirements and rewards of scientific training. In a recent survey of fifteen thousand high-school students, a significant percentage saw scientists as "evil," "poor family men," and "unconcerned with the welfare of others." "Forty-five per cent believe their school background is too poor to permit them to choose science as a career," says the report of this survey, and "thirty-five per cent believe that it is necessary to be a genius to become a good scientist."

IF misconceptions about science and scientists are at the root of the shortage, reason many scientists, why not do something positive in order to set young people's thinking straight? Why not bring the student into the research atmosphere and let him see the fields and techniques of science—and experience some of their satisfactions—for himself? Would this not be one way to stimulate and channel his interest in a science career?

Some organizations are doing something about it. Dow Chemical sponsors summer programs for high-school students, designed to encourage young people considering technical and science studies in high school and college. In 1954, when Dow made a special effort to place students in jobs relating to their past schooling or future scholastic ambitions, instead of in the usual summer jobs like maintenance, construction, and general labor, there were eleven applicants for each job.

The National Bureau of Standards has a junior scientist-engineer program which, according to the bureau's prospectus, is "designed to prepare especially well-qualified students for future professional careers. The students participate in a planned program of orientation, carefully supervised on-the-job training

The authors, John Balloch and Jean Taylor, have been research analysts on the senior staff of the Johns Hopkins Operations Research Office since 1952. They directed ORO's pilot summer training program for high school students during the summer months of 1956, and will direct another this summer.

assignments, and discussions with trainee advisers."

Perhaps one of the best-established programs aimed at discovering and stimulating potential scientific talent in young students is one inaugurated in 1948 by Mr. and Mrs. Fred Avis at the Jackson Memorial Laboratory in Bar Harbor, Maine, and later at St. Mark's School in Southborough, Massachusetts. Mr. Avis recognized that "by training young people before they finish secondary school, much time and effort is saved in orienting them to experimental research."

According to the 1956 catalogue of the Jackson Memorial Laboratory, "the experience of the past seven summers supports the belief that young people can obtain an early impetus and head-start in careers of medicine and in biological and psychological research. . . ." In the fall of 1954, forty-five of the seventy-five former students at Jackson were known to be in college, and ninety per cent of these were pursuing pre-medical or biological courses. Of the remainder, eighteen (twenty-four per cent) were still in high school, two were married, and ten could not be reached. Of the ninety-two students participating in the last five years, twenty-five have been the authors or co-authors of published scientific papers.

For years the Operations Research Office of the Johns Hopkins University, like hundreds of other laboratories and industries, hired high school students for summer jobs. But last summer ORO initiated a pilot experiment based on a new philosophy of summer employment. As ORO Director Ellis Johnson explains it, students were hired and trained for the sole purpose of increasing their potential as scientific investigators—not to assist only with the drudgery attendant to all research. The program was based on two assumptions: that if promising young people are treated as adults they will respond as adults; and that—given adequate leadership, resources, and motivation—high-school students can produce research of a high professional quality.

The ORO program (which will be expanded to include twenty-five this year) is designed to acquaint the student with a wide variety of scientific disciplines, to give him a realistic picture of scientists and the nature of scientific investigation, to give him a more valid understanding of his own strengths and weaknesses as they might influence educational and vocational choice, and, finally, to improve his scientific potential by giving him an opportunity to carry out a research project from inception to publication.

The nature of the work done by the Operations Research Office makes it an especially effective place to give young people a broad perspective of scientific endeavor. Possibly the most unique characteristic of operations research is that it is team research. Men from many disciplines study a common problem, each from the point of view specific to his field.

ORO was set up in 1948 by contract with the Army to undertake analytical studies of military problems by bringing together all possible courses of action,

Drawings for the Johns Hopkins Magazine by Jane Edmonds

measuring the effectiveness of each course, and comparing their possible cost in money and manpower. Thirty disciplines are represented on the staff; the members of any team represent the physical, biological, and social sciences, mathematics, engineering, and history. These study groups are, or have been, concerned with such investigations as the protection of the individual soldier, the effects of combat stress on infantrymen's performance, the accuracy of artillery, the potentialities of guerrilla warfare, close air support of ground forces, and measures for the defense of the U. S.

HIGH-SCHOOL students studying and working at ORO during the summer do not engage in any laboratory experiments in the strict sense of the word. But, because of the nature of operations research, they study, as a group, a larger problem using the techniques of several disciplines. They associate with scientists of many fields and experience the team approach.

Thirteen high school juniors and seniors were chosen to participate in the program last summer, all from the greater Washington area (ORO is in suburban Chevy Chase) and all recommended by high school science teachers or ORO staff members. They received a monthly salary.

To simplify administration of the training program and to promote an even quality of training, the students, with two exceptions, were kept together in a group under the direct supervision of two staff members, the authors of this article.

The program began with a battery of psychological tests. These included not only the standard intelligence and vocational-interest tests, but measures of the students' ability to deal in abstractions and mathematical formulas, their ability to manipulate designs in space, and studies of their value systems—whether their values were primarily aesthetic, political, theoretical, religious, economic, or social.

The group turned out to be remarkable in many respects. The median IQ was 128 (100 is normal for the population at large, and 110 is generally accepted as adequate for college work). The median student had more scientific interest and higher theoretical values than nine out of ten people. In all other aptitudes believed to be important in pursuing technical training, the median student exceeded nine out of ten people in the various norm groups on which the tests were based. Each student's individual test results were discussed with him during the summer. As further information about his background and interests was obtained, he was given more specific information about the requirements and rewards of various professions.

A second aspect of the program, designed to broaden the students' knowledge of the research world, was the

lectures on scientific disciplines and reviews of popularly-written science books. Men from such fields as engineering, physics, chemistry, and psychology addressed the group twice a week, describing the work they did, the training they would need in their chosen fields, and the opportunities in these fields. In addition, the students read books from the 150-volume traveling science library sponsored by the American Association for the Advancement of Science and discussed them weekly under the direction of various ORO staff members.

Every day for two weeks, the director of ORO's computer laboratory gave a course to acquaint the students with the capabilities of mechanical and electronic analog and digital computers. He introduced them to the history of computation aids and to the general steps in problem preparation.

THREE QUARTERS of the total four hundred hours allotted to the program were spent working on an actual research project. Several criteria guided the selection of the topic: it must be interesting; a large body of unclassified information about it had to be available; it had to be sufficiently difficult to present a real challenge. And, finally, it had to have community value. The choice: a civil-defense problem—investigating the radiation effects following a widespread thermonuclear attack on Washington and surrounding cities.

For the first week and a half, the students acquired an intensive knowledge of the research tools which the leaders thought they would need. ORO staff members briefed them on bomb physics, fallout and how it is measured, the effects of radiation on human beings, ways of estimating the distances by which weapons might miss their aiming points, how to use the Universal Transverse Mercator Grid System (found on Army maps). Finally, the directors of civil defense for the District of Columbia, the State of Maryland, and Montgomery County, Maryland, briefed them on local civil defense philosophies, plans, and problems.

During this intensive briefing period, the students gathered in sub-groups of four or five at the end of each day to discuss the effects on their research design of what they had heard or read. They discussed the proposals which emerged from these meetings with the two program directors and other ORO staff members. They made a constant effort to achieve clarity of purpose and to keep the project within the comfortable limits of six weeks' working time.

Finally they agreed upon a research design and submitted it to ORO's director. The plan was as follows:

Mock attacks with high-yield thermonuclear weapons were to be made on all the cities designated by the Federal Civil Defense Administration as "critical targets" within three hundred miles of Washington. The targets and the number of surface bursts assigned to each were as follows:

Allentown-Bethlehem-Easton	1
Baltimore	2
Harrisburg-Lancaster-York	3
Johnstown-Altoona	2
New York-N.E. New Jersey	7

Continued on page 23

The Lunatic Wept

ABRAHAM SIMMONS couldn't feel the frost that lined his tiny stone cage, or taste the swill they fed him, or chafe at his iron chains—so his keepers said. He was a madman.

But then, when his visitor, little Miss Dix, spoke softly, kindly, to him, why did he weep?

Dorothea Lynde Dix knew why. And her knowledge kept her fighting all her life to get the mentally ill away from pits and cages, whips and chains, and into hospitals.

In nearly 40 years, she paused only once—to render heroic service as superintendent of nurses in the Civil War. Then again she began investigating, writing, fund-raising, politicking, until this frail ex-school teacher had pushed a whole country into one of the finest reforms in its history: the sane treatment of the insane.

Dorothea Dix was fortunate in having one powerful ally: the American people. For as history will show, Americans are seldom self-satisfied; they long to do right. That urge has helped them build a strong, stable nation in a troubled world—and it has helped make their country's Savings Bonds a rock-ribbed assurance of security.

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A Johns Hopkins Gazette

AN UNOFFICIAL COMPENDIUM OF FACULTY AND ALUMNI APPOINTMENTS, HONORS, AND ACCOMPLISHMENTS

THE FACULTY

President Milton S. Eisenhower has been decorated by the Venezuelan government with the grand cordon of the Order of the Liberator.

AMONG MEMBERS OF THE BOARD OF TRUSTEES, Gary Black has been elected president of the board of directors of the A. S. Abell Company, publishers of the Baltimore *Sunpapers*.

John J. McCloy has been elected chairman of the board of trustees of Amherst College.

IN THE UNIVERSITY ADMINISTRATION, Keith Spalding has been appointed assistant to the president of the Johns Hopkins University.

IN THE SCHOOL OF HYGIENE AND PUBLIC HEALTH, Heinz E. Karrer, G. '53–'54, has been promoted to assistant professor of pathobiology.

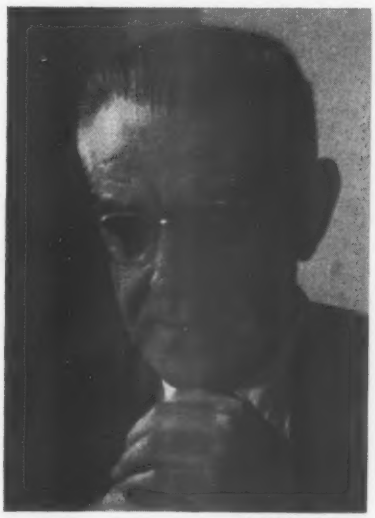
Charlotte Silverman, M.P.H. '42, DR.P.H. '48, assistant professor of epidemiology, has been appointed state epidemiologist and chief of the division of epidemiology and communicable disease control of the Maryland State Department of Health.

Robert E. Thomas, M.P.H. '55, has been promoted to assistant professor of public health administration.

Thomas B. Turner, professor of microbiology, has been appointed to the twelve-man advisory committee created by the U. S. Public Health Service to assist in administering its three-year nine-million-dollar grants program for building non-medical research facilities.

IN THE SCHOOL OF ENGINEERING, James F. Bell has been promoted to associate professor of mechanical engineering.

Charles D. Flagle, assistant professor of industrial engineering, has been appointed director of the newly established office of operations research at the Johns Hopkins Hospital. He will coordinate and bring continuity to that research in hospital administration, which, in the past, has tended to be pursued sporadically for only short periods of time.



ROBERT M. MOTTAR

Philip Bard

FABIAN BACHRACH

Thomas B. Turner

A CHANGE IN DEANSHIP

Philip Bard, dean of the School of Medicine since 1953, has resigned from that position in order to devote full time to his work as professor of physiology.

Dr. Bard, the holder of honorary degrees from the Catholic University of Chile, Princeton, and Washington and Lee, received all his academic degrees from Harvard.

He came to Johns Hopkins in 1933 as professor of physiology in the Medical School. Since then he has been elected to membership in the National Academy of Sciences, served as president of the American Physiological Society, and been president of the Association for Research in Nervous and Mental Disorders.

He is well-known for his scientific investigations, particularly for his studies of the nervous system.

Thomas Bourne Turner, professor of microbiology at the School of Hygiene and Public Health, has been appointed dean of the Medical School. He will succeed Philip A. Bard, who will relinquish the deanship in order to devote full time to his work as professor of physiology. Dr. Turner will also hold an appointment as professor of microbiology in the School of Medicine, both appointments beginning July 1.

Dr. Turner first joined the Hopkins faculty in 1927, as instructor in medicine. In 1932 he became a staff member of the Rockefeller Foundation, international health division. In 1939 he returned to Johns Hopkins as professor of microbiology in the School of Hygiene.

While on military leave as a colonel in the Army Medical Corps, he was awarded the legion of merit. He has published many monographs, papers and articles; the most recent is a two hundred fifty-page report titled *The Biology of Treponematoses*. His research interests have led him to do work on polio, tetanus, and other infectious diseases.

He was recently appointed by the Secretary of Health, Education, and Welfare to a twelve-man advisory council whose job it is to administer the government's new ninety-million-dollar program to assist in the construction of medical research facilities at institutions across the country.

A Johns Hopkins Gazette

CONTINUED

In the Faculty of Philosophy, William Foxwell Albright, W. W. Spence professor of Semitic languages, will be the Louis M. Rabinowitz visiting professor of Biblical history at the Jewish Theological Seminary of America for the years 1957–1959.

Charles R. Anderson, professor of American literature, has been appointed to the Caroline Donovan professorship of English literature made vacant by the retirement of Kemp Malone.

Donald H. Andrews, professor of chemistry, has been appointed B. N. Baker professor of chemistry.

Robert Cooley Angell, professor of sociology at the University of Michigan, is resident Deiches lecturer in human relations at Johns Hopkins during the current term.

Evsey D. Domar, professor of political economy, has been appointed visiting professor at the Massachusetts Institute of Technology for the current term.

G. Heberton Evans, B.A. '20, PH.D. '25, professor and chairman of the department of political economy, is on leave of absence for the current term to pursue a research project in England.

Philip E. Hartman has been appointed assistant professor in the department of biology.

Edward F. MacNichol, Jr., PH.D. '52 (biophysics), assistant professor of biophysics, is on leave of absence during the current term to do research at the Venezuelan Institute of Neurology in Caracas.

Clement L. Markert, PH.D. '48 (biology), has been appointed professor of biology.

Edwin S. Mills has been appointed assistant professor in the department of political economy.

James H. Oliver, professor of Greek, has been appointed Francis White professor of Greek.

John D. Strong, professor of experimental physics, has been awarded the Frederic Ives Medal "for distinguished work in optics" by the Optical Society of America.

Carl P. Swanson, professor of botany, has been appointed to the William D. Gill professorship in biology.

Charles S. Singleton, professor and chairman of the department of Romance languages at Harvard University, has been appointed professor of humanistic studies at Johns Hopkins.

Dr. Singleton will be returning to Johns Hopkins, where he was a member of the Romance language faculty from 1937 until 1950, when he went to Harvard as a full professor.

Although the major portion of his work will be with the Romance language department at Hopkins, he will co-ordinate his teaching with closely-related studies in philosophy, history, and the arts.

WALTER R. FLEISCHER

Charles Singleton

President Milton S. Eisenhower, in announcing Dr. Singleton's appointment, said: "Our studies in humanities will be greatly strengthened. By appointing him professor of humanistic studies we are furthering a concept in contemporary education which will benefit both undergraduate and graduate students pursuing training in broad fields."

Dr. Singleton, who holds a B.A. from the University of Missouri and a PH.D. from the University of California, is particularly interested in Italian literature, with special emphasis on Dante, Boccaccio, and the Italian Renaissance. He is currently working on a three-volume commentary of Dante's *Divine Comedy*. His appointment becomes effective July 1.

Carl B. Swisher, Thomas P. Stran professor of political science, has been chosen to give the 1957 Stokes lectures on politics at New York University.

John H. Young, PH.D. '42 (art and archaeology), associate professor of classics, has been appointed to the William H. Collins Vickers chair in archaeology.

In the School of Medicine, Ivan L. Bennett, associate professor of medicine, has been made a fellow in the New York Academy of Sciences.

Robert M. Chanock now holds joint appointments as assistant professor of pediatrics and assistant professor of epidemiology.

Nicholson J. Eastman, professor of obstetrics, has been elected president of the American Academy for Cerebral Palsy.

Jerome D. Frank, associate professor of psychiatry, has been elected to membership on the advisory board of the national training laboratory of the National Institutes of Health.

John K. Frost has been appointed assistant professor of gynecology.

Ralph G. Hills, M.D. '29, house staff '31–'33 (medicine), assistant professor of medicine, has been elected an alumni trustee of Princeton University.

Paul D. Hoeprich, instructor in medicine and epidemiology, has resigned in order to accept an appointment as assistant professor of medicine at the University of Utah School of Medicine.

Lawrence E. Shulman, assistant professor of medicine, has been given a senior investigator award by the Arthritis and Rheumatism Foundation. The award of thirty thousand dollars is in the form of a five-year fellowship.

Isadore Siegel, B.A. '19, M.D. '23, lecturer in obstetrics, has been promoted to clinical professor of obstetrics and gynecology at the University of Maryland School of Medicine. He is also obstetrician in chief of Sinai Hospital and director of obstetrics and gynecology at the Franklin Square Hospital in Baltimore.

John E. Raine, Jr., B.A. '38, has been elected a judge of the third judicial circuit of Maryland.

Harvey B. Stone, B.A. '02, M.D. '06, associate professor emeritus of surgery, has been appointed to the National Advisory Committee to the Selective Service System. This committee also

serves as the Health Resources Committee to the Office of Defense Mobilization.

Helen B. Taussig, associate professor of pediatrics, has been given the honorary title of professor emeritus and an honorary M.D. by the University of Athens, Greece.

In the School of Advanced International Studies, William C. Johnstone, Jr., professor of Asian studies, will be in Burma for the next two years as co-director of the Rangoon-Johns Hopkins Center for Southeast Asia Studies.

Majid Khadduri, professor of Middle East Studies, is on leave of absence during the current term and is visiting dean of the University of Libya in Bengazi.

Paul M. Linebarger, M.A. '35, PH.D. '36 (political science), professor of Asian politics, is on leave of absence during the current term and is lecturing at the National University in Sydney, Australia.

BOOKS

Elliott Jaques, M.D. '41: *Measurement of Responsibility: A Study of Work, Payment, and Individual Capacity* (Harvard, $3).

Samuel Eliot Morison, fac. '41–'42 (history): *The Intellectual Life of Colonial New England* (New York University, $4.95).

Herbert W. Schneider, fac. '48–'49 (philosophy): *Three Dimensions of Public Morality* (Indiana, $3).

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The following is the spring book-list of the Johns Hopkins Press, with approximate publication dates:

George Bluestone, PH.D. '56 (esthetics of literature): *Novels into Film* ($5; May).

Charles S. Campbell, Jr., assistant professor of history: *The Anglo-American Understanding: The Settlement of 1898–1903* ($5.50; May).

George F. Carter, professor of geography: *Pleistocene Geography and Early Man at San Diego* ($8; May).

John C. Eccles: *The Physiology of Nerve Cells* ($5.75; February).

Stefan Einarsson, professor of Scandinavian philology: *History of Icelandic Literature* ($5.50; June).

C. Grove Haines, professor of diplomatic history: *European Integration* ($5; May).

Alexandre Koyré, fac. '51–'52 (history of medicine): *From the Closed World to the Infinite Universe* ($5; March).

William D. McElroy, professor of biology, and Bentley Glass, professor of biology, editors: *The Chemical Basis of Heredity* ($12.50; February).

Charles V. Osgood: *Index: The Works of Edmund Spenser*, variorum edition ($3.50; April).

The Coming Choice For Psychiatry

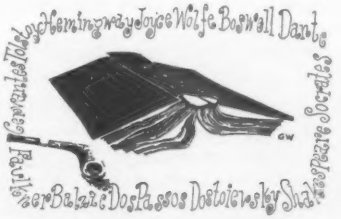
Continued from page 7

psychiatrists, is simply the effect of one person on another—an effect that might explain much of the success of psychoanalysis. Another consideration is the great length of time necessary for psychoanalytic cures. The question naturally arises, Would not many people, over such long periods, get well by other means? Many Freudians now agree that this possibility must be explored, although thus far they have shied away from statistical evaluation of psychoanalytic therapy, Dr. Gantt says.

One problem that has beset the Freudians, according to Dr. Gantt, is that when non-Freudian psychiatric methods have been introduced, psychoanalysts who have used them have had to fit them into the Freudian pattern.

For example, they attribute the possible benefit of shock therapy to the need of the patient for punishment, to satisfy the "guilt complex." Spectacular results obtained by the new tranquilizing drugs may also pose problems in terms of Freudian principles.

Another obvious question is this: Why did the doctrines of Freud become



A SURE HIT... this wonderful, washable jacket of Hopkins-blue poplin, treated with DuPont's durable water repellent, Zelan. It's a lightweight, unlined version of the jackets worn by members of Hopkins teams as they wait to go into the game, and any youngster would give almost anything to have one. Zippered front, two pockets, and the legend, "Hopkins, 19??" and the Hopkins jay in bright gold. Sizes 2, 4, 6, 8.....$4.25

JUNIOR T-SHIRTS... just like those the college men wear. Old favorites among the younger set. Sizes 2, 4, 6, 8, 10, 12.....$1.25

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The Coming Choice For Psychiatry

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so popular both in the narrow medical sense and in the broader cultural sense?

In 1940 Dr. Rudolf Allers, who has examined both the pro's and con's of Freudianism in his book *The Successful Error*, made some observations on the popularity of Freud. He wrote that Freud's theories appeared at a time when there was a need for "grasping man's life and personality in their concrete wholeness." Dr. Allers said science had failed to cope with the problems of the mind, and psychoanalysis was accepted as a "science of the mind."

"Secondly," Dr. Allers wrote, "psychoanalysis claims to have explained the very nature of man and to have solved many riddles which are insoluble by other psychologies. Man has become more of a problem to himself today than for many centuries. There has perhaps been no age which has been as anxious as ours to know the truth about man. Psychoanalysis declares it knows the answer."

"Thirdly," he wrote, "there is a certain factor which makes psychoanalysis acceptable to many, which factor indeed is more due to a misunderstanding of this theory than to an understanding of its true intentions. Psychoanalysis seems to procure a legitimation, by science, for the passions, the sensuous desires, and the illicit longings of human nature. It is easier to indulge in licentiousness if one may refer to the danger of repressing one's instincts."

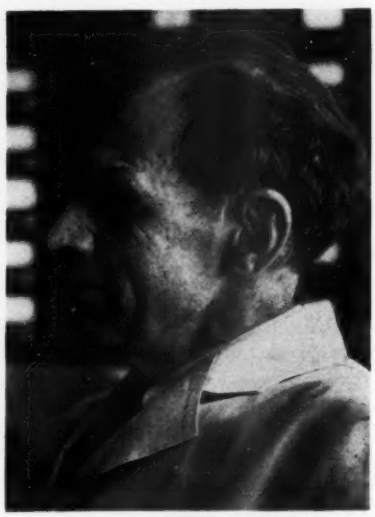
"Fourthly," according to Dr. Allers, "psychoanalysis meets the tendency towards irrationalism which is very widespread today. Freud's doctrine is in fact very rational; over-rational indeed. But the matter which is rationalized in this system is in itself irrational."

"Fifthly," he concludes, "psychoanalysis speaks an esoteric language. Its followers use certain terms which the uninitiated person does not understand. They nod at each other knowingly, possessors of secrets which the world in general does not share. They write and publish, indeed; they make known their ideas; they discuss with others. But all this has but little importance. The important thing is that to understand psychoanalysis fully you have to be analyzed. Analysis takes the place of a rite of initiation. Only those who have passed through the ordeal of analysis know the thing really and from the inside."

Dr. Pumpian-Mindlin asserts that serious scientists "may question some aspects of the material and the theoretical conclusions derived therefrom but they cannot discard the [psychoanalytic] structure *in toto*."

THE final question, then, is: What do the Pavlovians offer as an alternative in the field of psychotherapy?

Essentially, what they offer, or will offer, is a study of mental illness based on a background of unconditional and conditional reflexes. Inasmuch as these responses are for the most part unconscious, there is a kind of resemblance here between the causes sought by the Pavlovian psychiatrist and the psychoanalyst. The Pavlovian, however, does not universally seek the root of a neurosis in the sex instinct or in early childhood experiences; he seeks the root by surveying the whole field of instinct and innate equipment as a basis for conditioning and the acquiring of learned responses, including those that produce neurotic behavior.



WERNER WOLFF, BLACK STAR

W. Horsley Gantt

Dr. Gantt is the first to admit that the direct, full clinical application of conditional reflex therapy or preventive psychiatry remains to be developed. By its very nature it cannot be applied until the necessary objective data are compiled. But, says Dr. Gantt, "We have made a successful beginning, firmly based on scientific principles, which are extended gradually to interpret and treat more and more psychiatric disorders."

THE twenty-seven years of experiments conducted by Dr. Gantt cannot, of course, be described in a short article, but from his work certain interesting basic concepts have emerged.

The experiments that Dr. Gantt and his associates have conducted with dogs under controlled laboratory conditions have been continued through the lifetimes of a number of animals. Dogs are used because they have become inherently adapted to human surroundings as their "normal" environment. Dr. Gantt has watched dogs, under stressful conditions (brought about by confusing them after they have learned certain responses), develop human-like neuroses.

Certain dogs react neurotically to the appearance of a person, a human being, who is associated with the animal's earlier subjection to stress. (These signs of neuroses are, of course, objectively measurable.) This would indicate that if observable neurotic behavior can be induced in a dog by association with, or sometimes the mere appearance of, a particular person, the same might be true in human neuroses. Hence the wife who takes to her bed whenever her mother-in-law comes to visit. Dr. Gantt calls this concept *the effect of person*.

Two basic properties of an organism discovered by Dr. Gantt he calls *schizokinesis* and *autokinesis*. The first refers to the failure of an organism to adapt physiologically to what should be the needs of a particular situation. One of the examples cited by Dr. Gantt is the tremendous energetic response (as shown through increased heart rate) of a dog to food, far out of proportion to the physiologic task of eating. It is, he says, "like using a battleship to cross a stream when a rowboat would do."

Dr. Gantt speculates here that what is happening is that the dog is mobilizing the energy to chase down his prey, a rabbit perhaps. This energy was essential to his ancestors, who did not get food any other way. This innate response persists unnecessarily in a dog whose food is acquired without any effort. In this case, the organism does *not* develop the proper adaptive conditional reflex. It remains to be seen just

what maladaptations victimize the human being, conceivably causing emotional upsets without apparent cause.

Autokinesis is, in a sense, the antithesis of *schizokinesis*. It refers to the tendency of an individual to go on adapting or altering its internal responsive mechanism long after the reason for the alteration has passed. This characteristic can be either therapeutic or pathological, according to Dr. Gantt.

For example, Dr. Gantt subjected some of his dogs to stressful situations. Before any full neuroses had developed he took the dogs to his farm in Virginia where they led carefree lives for periods up to three years. Then, brought back to the Pavlovian laboratory and subjected to the same stress, they broke down completely, indicating that the stimulus of years before had started an internal alteration that made the dogs more susceptible to neuroses despite the interval of rest. Here, again, it is possible to speculate on the usefulness in human diagnosis and therapy. The origin of a nervous breakdown might be an unpleasant situation of years ago, only triggered by the immediate situation.

DR. GANTT, as well as some of his colleagues, believes that the greatest promise of his years of work is the possibility of an effective program of preventive psychiatry.

Through Pavlovian principles he believes he can discover those individuals who may become neurotic, *before* they break down, thereby giving them a chance to be on guard against the stresses for which their defenses are inadequate.

This possibility developed in the Pavlovian laboratory when Dr. Gantt noticed that some of his dogs, subjected to mild stress tests, showed a confusion and disturbance that preceded a later neurosis. Other dogs showed little or no confusion from the tests and never developed neuroses. Dr. Gantt believes these principles may someday be applied to a simple test for human beings, and preventive psychiatry might be as common as the chest x-ray.

Scientists For The Future

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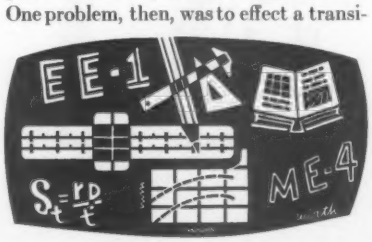
SINCE 1955, the U. S. Weather Bureau has been measuring the direction and velocity of upper winds—winds up to eighty thousand feet. These upper winds determine the direction and distance which small radioactive particles will travel, following an atomic ground-level explosion. The group decided to select a random sample of thirty-six days and, using wind data for sixty thousand feet (the approximate height of the mushroom cloud), actually plot the radiation conditions which would occur in every ten-kilometer square along the Eastern seaboard. These data made it possible to draw up sets of maps indicating how long there would be an excess level of radiation. The maps indicated that at least once in the thirty-six-day sample, large areas of the Eastern Seaboard would receive radiation, over two days' time, ranging up to 2300 Röntgens. Six hundred Röntgens is considered lethal to the entire exposed population.

To get further insight into the dimensions of the threat, one of the thirty-six days was chosen at random and radiation conditions in Washington examined more closely. On this particular day, the students assumed, one weapon fell near Catholic University and the other in the Washington channel. Of the 1.6 million people in the target area, 1.22 million were killed by blast, thermal effects, or fallout and heavy local radiation from the explosions, entrapped as they were by debris and thus denied rescue. Of the 380 thousand not trapped, fifty thousand were killed by other effects. This left 330 thousand people, or about one fifth of the original population, who could be rescued. This dismal finding led the group to conclude that a system of heavy shelters to protect the population from all effects was much in order.

THE program directors were totally unprepared for the high degree of dependence exhibited by the students at the beginning of the summer. Subsequent interviews indicated that many of the students came to the program with the expectation that they would be handed a completed research design and be told exactly what to do, each step of the way. As one student put it, "I expected it to be just more high school." One problem, then, was to effect a transition from dependence to independence. This was achieved partly through design and partly through chance:



Sub-groups, into which the students were divided while a research design and methodology were being devised for the project, familiarized the students with methods of suggesting and weighing ideas and making decisions regarding their inclusion in the over-all research design. This was a process that the project directors had planned deliberately.

But leadership emerged more from the exigencies created by doing an extensive research project in a short time than by the design of the adult directors. About one hundred fifty hours (or half the time devoted to the project) were needed for the rather tedious chore of data collection—adding up the fallout in each grid square following each attack. It came as quite a shock to many members of the student group that research entails a considerable amount of monotonous detail. They had been imbued, for the most part, with glamorous concepts of scientists, presented by television and motion pictures. There was considerable resistance to sticking to the data collection, and the program directors found that much of their time was spent just keeping the students at work.

The pressure of time came to the rescue. To complete the research within the summer it became necessary to overlap the data-collecting, the data-summarizing, and the writing-up of findings. Leadership began to emerge in the data-collection groups as some students became aware of the time limits. They

Scientists For The Future

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pushed others in the group to greater effort in order to meet deadlines.

At first the directors hoped that the entire group could write the report. But by and large the students had very little writing skill. Further investigation revealed that, due to large class sizes and other factors, high-school students are called upon less and less nowadays to write papers as part of their assignments, and that objective tests are rapidly replacing essay-type examinations at all levels. For many in the ORO group, this was the first time they had been called upon to express their thoughts on paper. After many abortive attempts to get students to rewrite their sections, the idea of getting everyone in on the final writing of the report was abandoned.

The task of writing the report fell to four students, who rewrote the work of the others. As they completed each section, they submitted it to the rest of the group for comment and criticism. An editor from the ORO staff worked with the group and taught them the essentials of scientific reporting.

It is a fairly simple matter to evaluate the research output of the student group. Their report was submitted in manuscript form to a review board of ORO scientists and high-ranking Army officers. The board was unanimous in feeling that the work was "an excellent research document and well worthy of publication by the Operations Research Office." The report has subsequently been printed, and, because of the demand for it from civil defense agencies and other interested persons, it has gone into a second printing. Briefings by the students held for ORO personnel and later for their parents, teachers, and friends elicited many favorable comments. When offered at the Eastern Colleges Science Conference, their presentation drew an extraordinary audience and created a new precedent—the first time the category of operations research had been included in the conference's eleven-year history. The group did, indeed, produce work equivalent to that of adults.

At the end of the summer the students evaluated the training program and made suggestions for future programs.

Most students doubted that vocational guidance, with their particular group, did much good, except to confirm career choices that had already been made. In future years, as more high-school juniors enter the program, and if some high-school people are sought out who have high science aptitudes but have not made firm career choices, the value of the guidance program will be increased.

The lectures and briefings by members of the professional staff, nine of the eleven participants said, were interesting and valuable. The reactions to the book-review sessions were, on the whole, favorable. There were vociferous comments about theoretical panel discussions given by ORO and visiting scientists, the general feeling being that the talks were over most high-school students' heads or that the talks were uninteresting. The computer lab course was mentioned by two students as one of the subject areas which interested them most; one mentioned it as least interesting, and two said they needed more help in understanding computer operation. The research project was considered, by all odds, the most interesting part of the program and certainly of the highest educational value.

In evaluating the over-all program, every student said, in an anonymous questionnaire, that he would like to work at ORO or in a similar job next summer. All the participants suggested showing the results of the program to other organizations, so that similar ones might be established elsewhere. One student wrote that the ORO training program "was a roaring success, accomplishing its aim: to give us a greater insight into the world of science by allowing us to work on our own piece of research."

From the viewpoint of the program directors, also, the project was a success. They developed an independence and self-direction they did not have when they arrived. As one ORO staff member who had an office nearby put it, "Those kids certainly grew up this summer."

Leadership emerged from the group and could be identified. In the anonymous sentence-completion test administered to the participants at the end of the program, this statement appeared: "If I had to choose just two people from the high school program to work with on a similar task next summer, I would choose ____ and ____." The four people whose names were most often inserted in the blanks were among those selected independently by the program directors to form a nucleus for next year's project.

The students gained a more realistic view of science and scientists. They discovered, for example, that it was "not as glamorous as it had been painted." "Up until now," wrote one student, "I had been quite hazy on the life and work of people in research and science." Another had, until his ORO experience, "thought that science was sacred." Several found that the greatest personal changes had come in realizing what was ahead in college and in improved working habits.

It will take decades to tell whether such programs as this will produce greater numbers of more productive scientists. ORO itself feels that summer high-school training programs hold great promise. But to make any dent in the shortage of technical manpower, thousands of industries and laboratories will have to undertake similar programs. ORO will continue its program and expand it, hoping that others will be encouraged by its success.

At Johns Hopkins

VARSITY SPORTS

NOTE—No admission fee is charged for Johns Hopkins home athletic events, but an admission card is required. Persons who wish to attend games during the current University year may obtain a card without charge by sending a stamped, self-addressed envelope to the Department of Physical Education, the Johns Hopkins University, Baltimore 18, Md. Alumni of the University should address their requests for admission cards to the Alumni Relations Office, the Johns Hopkins University, Baltimore 18, Md.

LACROSSE—Johns Hopkins vs. ARMY on Saturday, April 27 (Homewood Field at 2:30 p.m.); LOYOLA on Saturday, May 4 (away); NAVY on Saturday, May 11 (Homewood Field at 2:30 p.m.); MARYLAND on Saturday, May 18 (away); MOUNT WASHINGTON CLUB on Saturday, May 25 (Homewood Field at 2:30 p.m.)

BASEBALL—Johns Hopkins vs. DELAWARE on Tuesday, April 23 (away); LOYOLA on Thursday, April 25, (away); SWARTHMORE on Saturday, April 27 (Homewood at 12 noon); WESTERN MARYLAND on Thursday, May 2 (away); WASHINGTON on Saturday, May 4 (away); GETTYSBURG on Tuesday, May 7 (Homewood at 3 p.m.); CATHOLIC on Wednesday, May 8 (Homewood at 3 p.m.); WESTERN MARYLAND on Saturday, May 11 (Homewood at 12 noon).

GOLF—Johns Hopkins vs. FRANKLIN AND MARSHALL on Tuesday, April 23 (away); DELAWARE on Friday, April 26 (Mount Pleasant Golf Course at 1:30 p.m.); WESTERN MARYLAND on Tuesday, April 30 (Mount Pleasant Golf Course at 1:30 p.m.); GETTYSBURG on Thursday, May 2 (Mount Pleasant Golf Course at 1:30 p.m.); LOYOLA on Friday, May 7 (away).

TENNIS—Johns Hopkins vs. DELAWARE on Tuesday, April 23 (away); WESTERN MARYLAND on Saturday, April 27 (Homewood at 2 p.m.); TOWSON on Wednesday, May 1 (Homewood at 3 p.m.); LOYOLA on Thursday, May 2 (away); WASHINGTON on Saturday, May 4 (away); WESTERN MARYLAND on Wednesday, May 8 (away); CATHOLIC on Saturday, May 11 (Homewood at 2 p.m.); LOYOLA on Wednesday, May 15 (Homewood at 2 p.m.); MASON-DIXON Championships on Saturday, May 18 (away).

TRACK—Johns Hopkins vs. LOYOLA on Saturday, April 27 (Homewood Field at 12 noon); DELAWARE on Tuesday, April 30 (away); DICKINSON on Saturday, May 11 (Homewood Field at 11:30 a.m.).

MUSIC & DRAMA

JOHNS HOPKINS ORCHESTRA—The annual concert of the orchestra made up of Hopkins faculty, students, and staff will be held on Sunday, May 12 in Shriver Hall.

THE TIME OF YOUR LIFE—The play by Robert Sherwood will be produced by the Barnstormers, student dramatic group, on Friday and Saturday, April 26 and 27. (Shriver Hall at 8:30 p.m., admission free)

THE PLACE OF THE NON-PROFESSIONAL THEATRE IN AMERICA—N. Bryllion Fagin, associate professor of English and drama, will speak at a drama evening sponsored by the Johns Hopkins Playshop. (Sunday, May 5 at 8:30 p.m. in the Clipper Room of Shriver Hall. Admission, 60 cents.)

ALUMNI MEETINGS

ENGINEERING ALUMNI—The annual engineering alumni dinner will be held on Friday, May 10 at 6 p.m. in Levering Hall on the Homewood Campus.

ALUMNI HOMECOMING—A full program of events is scheduled for this day of reunions and festivity, centering around the Hopkins-Navy lacrosse game. The program: inspection tours of the campus in the morning, BUFFET LUNCHEON at 12 noon in the gymnasium (reservations may be made through the Alumni Relations Office), parade of classes at 1:30 p.m., LACROSSE GAME at 2:30 p.m., fraternity open houses after the game, REUNION DINNERS for classes with numerals ending in 2 and 7 at places to be announced (Saturday, May 11).

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